ANNUAL REPORT OF GENERATION PLANNING

1982/83 to 1996/97

System Planning Division

1982/83
GENERATION PLANNING ANNUAL REPORT
FOR
THE 15 YEAR PERIOD 1982 TO 1996

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GLOSSARY OF TERMS

The following is intended to give the reader an understanding of the technical terms and definitions used in this document.

a) Capacity is a term sometimes used in place of generating capabilities.

b) Demand is that total power system load which must be served. It is usually tabulated by the hour and measured in units associated with electric power, watts; in the electric utility business, the large magnitudes concerned have resulted in the following:

TERM	SYMBOL	MEANING
WATT	w	Power supplied or used
KILOWATT	KW	Thousands of Watts
MEGAWATT	MW	Millions of Watts

c) Energy, or work, in the electric utility business is usually expressed as the product of power with time, or watt-hours; the large magnitudes usually dictate the following:

TERM	SYMBOL	MEANING
WATT-HOUR	Wh	Power supplied over time
KILOWATTHOUR	KWh	Thousands of Wh
GIGAWATTHOUR	GWh	Thousands of millions of Wh.

d) Forecast Demand is the total system load which will most probably have to be supplied. It is taken from the 1982 NB Power Load Forecast and is expected to occur in the month of January.

e) Generating Capability is the output power which can be provided from existing (in-service), committed (under construction), and planned (future commitment) generating stations on the NB Power system. This output is derived from tests, experience and calculations.

i) The Peak Electrical Capability is that system generating capability available to supply the peak forecast demand; it is the total related capability of all thermal and hydro stations.

ii) The Sustained Electrical Capability is that system generating capability available to supply the forecast demand over whatever duration it occurs; hydro capability is adjusted to account for the limited energy available under lowest considered river flows.

f) Participation Sale is the contracted sale of a portion of a particular generating unit. An example of this is the participation sale of Coleson Cove to New England.

g) Reserve is a term used to describe that quantity of power considered by a utility to be necessary to add to the generating capability; that is, to have "on reserve", to ensure meeting forecast demand under contingency conditions.

i) Reserve for Peak Electrical Capability is set at 20% of forecast demand.

ii) Reserve for Sustained Electrical Capability is the additional capability which is necessary to meet forecast demand if the largest single thermal unit loading relied on in the Maritime Systems is out of service.

I INTRODUCTION

This 1982/83 Generation Planning Annual Report analyses NB Power's ability to supply the forecasted provincial electrical demands. The analyses covers the fifteen year period from 1982 to 1996 inclusive. The report also identifies and comments on what future supply sources will be considered when new generation is required.

The identification of development opportunities is a continuing process and is influenced by changing economic conditions and often by such government incentives as the National Energy Policy. The more promising current options are discussed in this report.

Generation Planning activities concentrate both on the requirement for new generating facilities as well as the potential for modifications to existing generating facilities for the purpose of displacing some of the remaining fuel oil requirements. In analysing the alternatives available to meet future expected customer demands, the resources development opportunities which remain in the Province are considered in conjunction with the full potential of interconnected and co-ordinated operation with neighbouring utilities.

Specific emphasis has been, and is continuing to be, placed on reducing the utilities exposure to the uncertain cost and reliability of supply of oil. This has led to the development of the Lepreau #1 nuclear unit, and the study of the possibilities for conversion of existing oil-fired generating units to alternate fuels where economic-

ally and technically feasible. The development of potential provincial resource based facilities and additional interconnections is also part of this emphasis. Such an approach could ultimately relegate the remaining oil-fired generation to a reserve role on the NB Power system.

II BACKGROUND

The primary objective of NB Power is to develop a long term economic and secure supply of power capable of producing safe and reliable energy.

A major part of NB Power's development philosophy has been, and continues to be, one of taking maximum advantage of New Brunswick's unique geographical position thereby developing strong interconnections with the large neighbouring power systems. This allows NB Power to import significant quantities of electrical energy where it is economically available externally and to install large, and efficient, generating units within our Province which could not otherwise be undertaken.

NB Power, as a result of this strategy, has been able to develop a power system based on the closely coordinated interests of neighbouring utilities. This has resulted in the installation of the Lepreau nuclear generating unit. The development of these strong interconnections, will help to ensure the ability of the utility to efficiently meet consumer requirements well into the future.

III SUMMARY

a) General

An analysis of the capability versus demand for the period under review indicates that based solely on the forecasted in-province load requirements there is no capacity shortage until the mid-1990's. However, there continues to be a need to consider energy alternatives to further reduce the dependency on imported oil. This leads to the potential to adapt existing oil-fired generating facilities to alternative fuel sources.

The long term provincial load demand as shown in the 1982 Load Forecast[1] is slightly lower than the previous year's forecast. Based on this forecast demand, the need for expanded firm generating facilities to meet in-province load does not occur until the mid-1990's. This does not necessarily mean that the decision to construct new facilities can be delayed accordingly since the lead times required to complete plant construction is also extending.

In consideration of the need to further reduce the dependency on oil and the lead time needed to complete new facilities, NB Power is reviewing and weighing the advantages and disadvantages of a number of alternatives. These include expanded interconnection capability, additional coal burning capability, nuclear additions, expanded hydro including storage and utilizing natural gas, heavy fuel oil and thermal peat as alternative fuel supply for specific units. The ultimate decision on which alter-

natives to develop and their timing is largely influenced by the availability and price of the energy sources being considered. Fortunately, NB Power has over the past twenty years developed a succession of strong interconnections with its neighbouring electric utilities thereby enabling NB Power to achieve maximum flexibility in either purchasing from another system if they should have surplus or installing economic generation on the NB Power system which would otherwise not have been undertaken on an isolated basis. The development of any alternative supply, therefore, requires that close co-ordination be maintained with all adjoining utilities.

b) Review of Options

In the past year, NB Power has been able to complete an understanding with Hydro-Quebec which has led to the installation of a second major interconnection between the two utilities. This second interconnection will be located in the Northwestern (Edmundston) area of the province and will by 1985 have a transfer capability into the New Brunswick system of some 500,000 kilowatts. The combined capability when put together with the present Eel River interconnection will provide a total capability with Hydro-Quebec in excess of 1,000,000 kilowatts. The current plans for the Edmundston area interconnection is to have a 50,000 kw capability in the spring of 1983, increasing to 150,000 kw in 1984 and to 500,000 kw by 1985.

This second interconnection with Hydro-Quebec will make additional energy available to displace higher cost New Brunswick energy as well as allowing lower cost energy to be available to the other Maritime Provinces. It also

means a significant reduction in the annual air emission from regional fossil fired generating stations.

The Power Costing agreement between NB Power and Hydro-Quebec is such that the cost saving to New Brunswick is limited to 20% of the cost of the displaced fuel in the NB Power system. The agreement also allows for NB Power receiving about 15% of the cost of displaced fuel in neighbouring utilities who benefit from the available Hydro-Quebec energy.

In addition to the benefits to NB Power there are significant impacts or benefits to the Government of Canada through the saving of compensation payments on the oil which would otherwise have been consumed. This results in a positive effect on the country's balance of payments position. The existing Hydro-Quebec interconnection alone has consistently replaced some 4,000,000 barrels of fuel per year and the second tie has the capability to displace an equal amount.

The increased Hydro-Quebec tie capability when combined with our in-province surplus capabilities has led NB Power to explore means to increase the tie line capability with New England. Joint studies are underway to explore ways to technically increase this tie line from its existing 600,000 kw capability to 700,000 kw.

The 1981 Generation Planning Annual Report noted that the 3-335,000 kw Coleson Cove units and the 100,000 kw Dalhousie number one unit are being considered for conversion from oil to coal.

The Coleson Cove conversion option was put forward as part of the Federal Government's 1980 National Energy program. A three phase study plan was prepared by NB Power in response to this federal program. The objective of the study was to evaluate the technical, economic and environmental consequences of converting all or a portion of the Coleson Cove station from residual oil fuel to pulverized coal. A multi-phase study plan was selected in order to reduce the conversion options to a single alternative for detailed assessment in the final phase.

Early in 1982, the second of three phases of the study was completed. The results revealed that the overall preferred option was to convert Coleson Cove to coal by the modification of the 3 existing boilers to permit coal firing. The study concluded that, when fired with a high quality sub-bituminous coal from eastern U.S. or western Canadian sources, 75% of the present electrical generating capability could be retained. Since the plant would continue to have the capability to burn oil, it could retain 100% of its generating capability should the need for additional generating capability ever exist.

As a result of recent discussions with the Federal Department of Energy, Mines and Resources, it has been agreed that both parties would work toward resolving the issues needed to permit a decision to undertake Phase III of the study. This final phase of the study may be undertaken when the economics of conversion are better known and environmental and financing criteria for the project are understood and agreed to. The recent slowdown in the increase in the price of fuel oil will have to be evaluated to decide if Phase III should be undertaken at this time.

Conversion of Coleson Cove to coal would undoubtedly require fuelling by other than New Brunswick coal due to the large quantity of coal needed to meet the requirements of this station as well as the increasingly stringent emission standards currently being promoted. Conversion of this facility to coal will also be very expensive. Depending on the method of conversion, costs (in 1982 $'s) could exceed $300 million. Its economic feasibility for New Brunswick is very dependent on Federal Government support as implied in the National Energy Program. It may be that increasing requirements for very expensive emission control equipment will, in itself, make the project uneconomic.

Further coal-fired alternatives which are being considered relate to the possible development of a new 200,000 kilowatt coal-burning plant at Grand Lake and the possible conversion of the 100,000 kilowatt Dalhousie No. 1 unit, both of which, it seems, could reasonably be carried out to burn provincially mined coal. The desirability of these options is further enhanced by the demonstrated ability, particularly at Grand Lake, to effectively utilize the waste heat for purposes of trout and salmon rearing and for possible greenhouse development.

The continuing concern with respect to "acid rain" as logical as it may be from a "National" point of view, could seriously impair the development of local coal resources. It can only be emphasized that such concerns and policies related to them should never be promoted, nor developed, without a full understanding of the factual problems that exist and the very negative impact that such policies could have on the provincial economy.

In addition to the increased utilization of coal, NB Power is also studying the possibility of achieving the ability to burn other fuels at the Coleson Cove Station. They are:

i) Oil producing countries, Venezuela in particular, have resources of very heavy crude oil which is difficult to be refined and, therefore, are available as a fuel for thermal plant consumption. Coleson Cove was designed with provisions to burn both crude and residual oils and therefore can, with minimum modifications, burn this potentially available fuel if it becomes economically attractive.

ii) Indications are that natural gas may be introduced to the region within this decade. Natural gas, being a prime fuel for many aplications, can also be used to fuel electric thermal generating plants. There are many reasons to consider natural gas for such use, particularly in New Brunswick. New Brunswick has been given assurance by both the Federal Government and the Province of Alberta that while they do not support burning gas in power plants in principal, they do support it during the early years of availability in this province due to the important contribution such use can make to a viable natural gas market development. Such utilization would allow the benefits of natural gas to be immediately made available to all New Brunswick residents in the form of electric energy.

iii) Residual oil will always be available to some degree as a refinery by-product requiring the thermal plant market to utilize this product. Therefore, any conversion must retain the ability to burn residual oil when it is economically desirable to do so.

A second nuclear unit at Point Lepreau offers significant potential to avoid again placing this province in a position of increasing reliance on imported oil in the future and it will be a prime candidate for development to meet the additional capacity requirements of the mid-1990's. Its early installation could have a highly beneficial impact on consumers and on the provincial economy but any such undertaking would require major federal financial involvement, assurance of full co-operation by organized labour and participation by neighbouring utilities during the early years of operation. If these conditions are achieved, and if undertaking of the project is seen by the Commission and the Government as being in the best long term interest of New Brunswick's energy supply future and its developing economy, it could proceed at a reasonably early date.

A number of hydraulic generation options have been identified which could have considerable potential long term benefits for New Brunswick consumers. However, the larger and potentially more feasible options present a financial burden during the early years of operation. To avoid passing such financial burden to NB Power customers, it would require that early year outputs be shared with neighbouring utilities. This requirement is a common one

for large developments and ensures that their undertaking yields short term, as well as long term, financial benefits.

The raising of the Mactaquac headpond is one option which NB Power is presently pursuing and hopefully should be completed in the near future.

There is continuing Provincial and Federal Government interest in developing a peat-fired demonstration thermal project to provide an opportunity to test the overall utilization of thermal peat to generate electricity. The economics of a demonstration project are such that it could not be undertaken by the utility alone but rather as a co-operative venture with government(s).

Investigations undertaken to date indicate that there are significant provincial resources of peat which appear suitable for thermal plant use.

The encouragement of conservation and the desirability of load management will continue to play an every increasing role in ensuring the most efficient use of energy. The expected results of these activities are considered in the development of forecasts of the requirements the customers will place on the utility.

The sections of the report which follow relate to the specific options in more detail and, of course, discuss the overall requirement to supply, and the resources available and being developed to meet, that requirement.

IV CONCLUSIONS

Generation Planning is a continuous process of review of both the load forecast and the technical and economic analysis of various alternatives which could meet these increasing requirements.

The Annual Report on Generation Planning presents, for the 15 year period considered, a comparison of the NB Power "Generating Capability" with the total electrical "Forecast Demand". It illustrates the developments which will meet these requirements and the further opportunities that exist during the period.

With the presently installed generation and the Point Lepreau number one generating unit together with available purchases from neighbouring utilities over existing interconnections, NB Power will have facilities in place to meet the presently forecast in-province load growth into the mid-1990's. Opportunities also exist to improve cost and supply security, and to impact favourably on the provincial economy through development or conversion options that exist.

New Brunswick is fortunate to have a number of development paths available such as additional coal and nuclear units, thermal peat, tidal, hydro and expanded interconnection purchases. These paths can, as the right combinations are identified and developed, ensure the best possible evoluation of the power system to meet the needs of the 1980's, the 1990's and beyond. The overall picture is one of increasing self sufficiency in the provincial

and national context, with relative cost stability, and with significant opportunity within the current decade to undertake projects which can improve New Brunswick's energy future and have a major, and beneficial, impact on New Brunswick's economy.

V GENERAL

The "Generating Capability" of the NB Power system is the output power which can be provided from existing (in-service), committed (under construction), and planned (future commitment) generating stations on the NB Power system. This output is derived from tests, experience and calculation.

The "Forecast Demand" is that total system load which will most probably have to be supplied. It is determined by forecast[1], using available information, experience, advice and detailed studies, for the planning period under consideration.

The term "Generating Capability" must embrace both a "Peak Electrical Capability" and a "Sustained Electrical Capability".

The "Peak Electrical Capability" of a generating system is its maximum ability to meet the total electrical forecast demand at any point in time. In this case thermal, nuclear and hydro generating stations are considered to be available at their full rated generating capability.

The "Sustained Electrical Capability" is the ability of the system to meet a continuous electrical demand for whatever duration it may exist. In this case the generating capability of hydro stations is adjusted to account for the limited energy available under the lowest reasonable hydro generating conditions. The most critical period for consideration of the sustained supply and demand conditions is the December through March period each year; that is also the period during which the peak load hour occurs.

The often stated difficulty in appreciating the role played by New Brunswick's hydro plants in meeting "Peak Electrical Capability" requirements, as compared to their contribution to "Sustained Electrical Capability" requirements, is understandable. Our existing provincial hydro generating stations are essentially run-of-river developments with limited potential for storage of water within the headponds and up river storage reservoirs. In other words - the river flow varies with rainfall, temperature, snow melt conditions, or extended draught.

To make a comparison - if you have, for instance, a 1000 gallon gasoline tank from which you have to supply a requirement throughout the day - and it is only possible to have it refilled once a day - then you have the option of using it all in, say, one hour or spreading its use over each hour of the day. If it is withdrawn in one hour it can be said to meet a "peak demand" of 1000 gallons per hour for one hour. It could alternatively be used to supply a "sustained demand" of 84 gallons per hour for each of 12 hours or a "sustained demand" of 42 gallons for each of 24 hours.

Run-of-river hydro plants, during periods of limited flow, such as the months of December, January and February, have a similar characteristic. They can produce full output for a limited time period but cannot sustain it for a full day. Thus the "Peak Electrical Capability" of a run-of-the-river hydro plant and, therefore, its ability to meet an immediate emergency requirement or a demand during the peak hour of the day - is much greater than its ability to maintain a "Sustained Electrical Capability" for extended hours of the day. During a period of very high stream flow, of course, its "Sustained Electrical Capability" is much greater and may even match its "Peak Electrical Capability".

Thermal and nuclear plants, providing they have a continuous fuel supply and do not have to be shut down for repairs, have the capability to provide a "Sustained Electrical Capability" equal to the "Peak Electrical Capability". A well planned and developed power system utilizes the available generation types in a manner that most economically meets the widely varying load requirements.

"Generating Reserve Capability" must be maintained to ensure meeting forecast demand following partial loss of electrical generating capability. The "Reserve for Sustained Electrical Capability" is the additional capability which is necessary to meet the forecast demand, if the largest thermal unit loading relied on in the Maritime systems is out of service at a time of lowest stream flows. The "Reserve for Peak Electrical Capability" is set at 20 percent of forecast demand.

The comparison of generating capability with forecast demand plus required reserves - determines the surpluses, or deficits, that will be experienced during the period to 1996/97 with presently planned facilities. Table I presents this comparison where all of the defined quantities are expressed in megawatts.

Committed generating capability which is being incorporated into the existing NB Power system during this period includes:

1. The addition of the 630 MW Point Lepreau nuclear unit with its long term stability of energy costs. In order to ensure maximum benefit from a unit of

this size, its introduction into the system includes sale of part of its output during its early years, to other systems with a return to the NB Power system as the output can best be fully utilized. Participation sales for some 265 MW's of the Point Lepreau output have been negotiated with neighbouring utilities.

2. Capability to meet both peak and sustained electrical demands increases with the termination in November 1985 of the commitment by the Maine Electric Power Company and the Federal Government to 400 MW's of the output of the Coleson Cove Generating Station.

   This arrangement allows NB Power to meet part of its increased power supply requirements with generating units installed at mid '70 costs.

In examining Table I it will be noted that the period under review has a satisfactory balance between "Sustained Electrical Capability" and forecast demand plus required reserve.

An analysis of capability versus demand for the period under review indicates that additional generation is not required solely to meet presently forecast in-province requirements.

Lead times involved in plant construction are extensive and, as a result, firm decisions on generation development to meet future load demands have to be taken many years in advance of indicated requirements. Alternative generating sources are presently being examined as possibilities for development to ensure full displacement of oil fuel, to improve utilization of

TABLE I

SUMMARY
FORECAST ELECTRICAL DEMAND vs GENERATING CAPABILITY
PERIOD -1982/83 - 1996/97
(MEGAWATTS)

Fiscal Year	PEAK ELECTRICAL CAPABILITY: Forecast Demand Plus Reserves[1]	PEAK ELECTRICAL CAPABILITY: Generating Capability	PEAK ELECTRICAL CAPABILITY: Surplus/ Deficit	SUSTAINED ELECTRICAL CAPABILITY: Forecast Demand Plus Reserves[2]	SUSTAINED ELECTRICAL CAPABILITY: Generating Capability[3]	SUSTAINED ELECTRICAL CAPABILITY: Surplus/ Deficit
1982/83	1944	2467[4]	523	1813	2071	257
1983/84	2080	2467	307	1947	2082	134
1984/85	2130	2467	337	1993	2073	80
1985/86	2186	2867[5]	681	2042	2473[5]	431
1986/87	2248	2867	619	2091	2473	382
1987/88	2312	2867	555	2140	2483	343
1988/89	2376	2867	491	2187	2491	304
1989/90	2437	2867	430	2233	2499	265
1990/91	2715	3132[6]	417	2541	2771[6]	230
1991/92	2767	3132	365	2586	2780	194
1992/93	2819	3132	313	2631	2788	157
1993/94	2873	3132	259	2678	2796	118
1994/95	2926	3132	206	2723	2804	80
1995/96	2981	3132	151	2770	2812	42
1996/97	3035	3132	97	2816	2820	4

Notes:

See Page 20 for Notes [1] to [6].

NOTES - RELEVANT TO TABLE I

1. Reserve for peak electrical capability is set at 20 percent of forecast demand or the capacity of the largest unit whichever is greater.

2. Reserve for "Sustained Electrical Capability" is the additional capability which is necessary to meet the forecast demand if the largest single source of generating capability relied on in the Maritime systems is out of service during periods of low river flows. The generating capability of hydro stations is adjusted to account for the limited energy available under the lowest expected hydro generating conditions.

3. Capability to meet Sustained Electrical Demand increases by about 8 MW annually as increasing system demand permits more effective utilization of the installed hydro generation during peak loading periods.

4. Capability to meet both peak and sustained electrical demands increases by the addition of the 630 MW Lepreau nuclear plant in full service by early 1983. An amount of 365 MW of the Lepreau generation is considered as retained for generating capability for NB Power while 265 MW is considered for participation sales in the export market, returning as generating capability available to NB Power at the end of the decade.

5. Capability to meet both peak and sustained electrical demands increases in November 1985 by 400 MW with the return of the Coleson Cove participation sale.

6. Capability to meet both peak and sustained electrical demands increases by 265 MW's with the return of the nuclear participation sales.

provincial resources, and to provide beneficial impacts on the provincial economy.

The surpluses of "Sustained Electrical Capability" noted throughout the 1980's could be utilized to replace capacity lost at Coleson Cove and Dalhousie plants during the period these units would have to be out of service if conversion to coal firing was undertaken. This assumes that investigations prove these to be economic and acceptable within the specific and general objectives of the National Energy Policy and in the best interests of the New Brunswick consumer.

There continues to be a need to consider energy sources to further reduce dependency on imported oil and a need to adapt existing facilities, as opportunities arise, to best meet provincial requirements. Thus, the Commission is continuing to explore opportunities to fully utilize energy sources available within the province and to acquire energy sources as may be available external to the province and region. These include increased interconnection capbility, added nuclear, extended coal development, natural gas, peat and hydro including storage development. Conversions of existing facilities from oil fuel to coal and/or natural gas are also being explored.

The NB Power system has been developed with "regionally" sized units using early year sales to neighbouring utilities to permit effective integration of such large generating units into its overall power supply. It has also developed "regionally" sized interconnections with the Nova Scotia, Quebec and New England systems.

VI THE REQUIREMENT

a) Load Forecast

NB Power's 1982 load forecast[1] indicates a lower than historical growth rate. It predicts an average growth in demand of 3.1% per year over the coming 14 year period. This compares with the 1981 forecast of an average growth in demand of 3.4% per year over that 14 year period.

These tendencies are illustrated in Figure 1 which presents a comparison of the 1982 and 1981 load forecasts. The actual peak loads experienced in recent years are plotted for comparison.

The development of an expected load forecast, which looks well into the future, is a vital element in reaching conclusions on future generation development. The number of years which must be forecast is directly related to the time it takes to build new generating facilities. The longer into the future forecasts are made the greater the uncertainty that results in projecting the magnitude of industrial and domestic growth, future economic policies, costs of alternate energy sources, and social trends that should be considered.

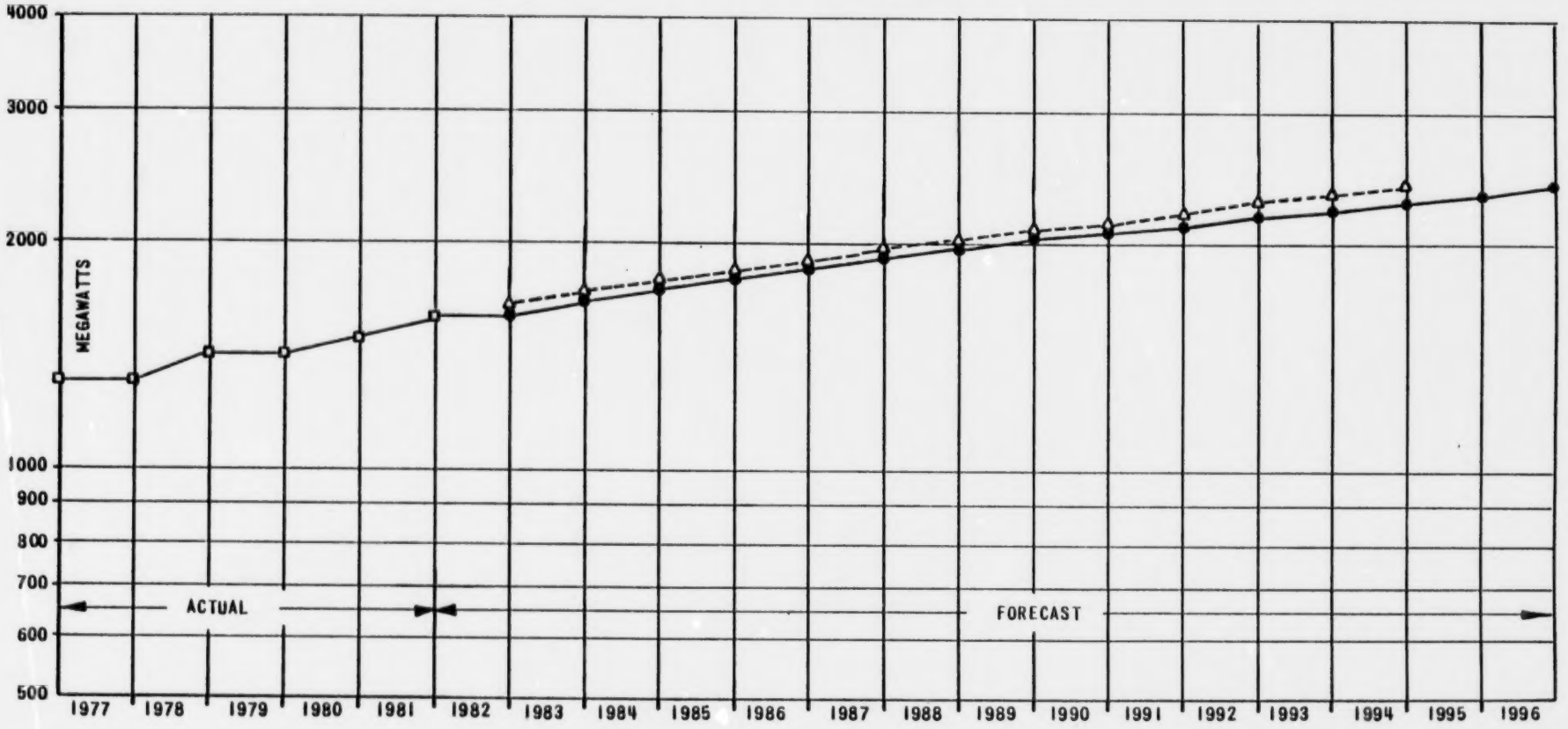
In the New Brunswick situation the risks of judgements that might cause short term over or under installations are greatly mitigated by the availability of high capacity interconnections with large neighbouring utilities over which short term capacity sales and purchases can more readily be made.

FIGURE I

N.B. POWER

IN-PROVINCE ANNUAL PEAK DEMAND

FOR MONTH OF JANUARY (MEGAWATTS)



LEGEND:

ACTUAL PEAK LOAD

1981 FORECAST

1982 FORECAST

NOTE: SEE TABLE IV FOR ACTUAL VALUES

Because of all of these factors and the many variables that influence them, the generation planning process must consider load uncertainties. In a climate of uncertainty, the generation planning process becomes more than a review of both the load forecast and the technical and economic analysis of various acceptable alternatives in meeting any increased requirements. It is, primarily, a resource planning exercise to determine the most efficient application and utilization of existing and committed resources, both in the time span of the first five to eight years when the forecast is most certain as well as an examination of alternatives available to meet requirements indicated toward the end of the period when the forecast is less certain.

b) Planning Criteria

NB Power utilizes two reserve criteria in the assessment of the reliability of their generating system. The capability of the system is assessed against both of these criteria as outlined in the General section of this document.

i) Reserve Criterion for Peak Electrical Capability

The NB Power reserve criterion for Peak Electrical Capability requires that the total capacity available in each month should be able to supply the load during the peak load hour of the month with a surplus equal to 20 percent of the forecast firm in-province load or the capacity of the largest unit, whichever is the larger. To meet this criterion thermal and hydro stations are considered as available at their full rated generating capabilities as given in Table III.

ii) Reserve Criterion for Sustained Electrical Capability

The reserve criterion for sustained electrical capability requires that Nova Scotia, Prince Edward Island and New Brunswick jointly be able to withstand the continuous loss of the largest generating unit loading relied on in the interconnected area. Under such reserve sharing arrangements, it is usual that the capacity of this largest generating facility loading does not exceed about 10 percent of the combined load of the participants. Because of anticipated participation sales of 265 MW from the Point Lepreau nuclear unit, a maximum unit loading of 365 MW will be relied on within the NB system from that unit until the end of this decade. Should the extent of reliance on this unit loading exceed that provided for under the Maritime reserve sharing agreement, NB Power can take advantage of arrangements available to it under its interconnection agreements with large neighbouring systems to provide adequate sustained electrical capability reserve. Such arrangements are made possible by NB Power through the high capacity interconnections and are within the normally anticipated inter-utility relationships represented by interconnection agreements.

Results of the most recent analysis of generation requirements and committed supplies[2] are summarized in Table II. Surplus (deficit if applicable) generating capabilities are presented which indicate NB Power's position relative to requirements for supply to New Brunswick customers through the period 1982/83 to 1996/97 (including reserve requirements for existing and committed units).

TABLE II

ANALYSIS OF GENERATION REQUIREMENTS AND COMMITTED SUPPLIES-SURPLUS/DEFICIT (JANUARY)

FISCAL YEAR	PEAK ELECTRICAL CAPABILITY (MW)	SUSTAINED ELECT. CAPABILITY (MW)[1]
1982/83	523	257
1983/84	387	134
1984/85	337	80
1985/86	681	431
1986/87	619	382
1987/88	555	343
1988/89	491	304
1989/90	430	265
1990/91	417	230
1991/92	365	194
1992/93	313	157
1993/94	259	118
1994/95	206	80
1995/96	151	42
1996/97	97	4

Notes:

1. Sustained Electrical Capability surpluses will be reduced if Coleson Cove and Dalhousie oil-fired thermal units are taken out of service for conversion to coal.

VII AVAILABLE CAPABILITIES

The NB Power system is comprised of a mix of hydro, coal-fired thermal, oil-fired thermal and gas turbine generation. Additionally, the nuclear generation at Point Lepreau is approaching commercial availability. A summary of the capabilities of the installed and committed generation is given in Table III.

NB Power also purchases energy from neighbouring utilities through its interconnections to displace more expensive generation and can also purchase capacity as required to meet firm load when available and economic. While there is presently no defined availability of firm capacity it is known that Hydro-Quebec has considerable excess energy for sale throughout the 1980's. It is reasonable to expect that this energy will be available for fuel displacement.

From examination of the analysis of generation requirements and committed supplies it is obvious that with the expected forecast growth rates, NB Power will not require added generation until the mid 1990's other than that which may be undertaken to further reduce dependency on imported oil or to meet long term objectives through early development supported by sales to neighbouring utilities. The generation/demand position is illustrated graphically in Figure II.

TABLE III

GENERATING STATION CAPABILITIES - NET MEGAWATTS [1] (MW) EXISTING AND UNDER CONSTRUCTION

Name of Plant		Hydro	Name of Plant	Type of Fuel	Thermal & Nuclear	
Mactaquac	1	100	Grand Lake			
	2	105				
	3	103		Coal	5	4.8
	4	110		Coal	6	4.8
	5	107		Coal	7	12.6
	6	109		Coal	8	57.1
Beechwood	1	36	Chatham	Coal/Oil	1	9.4
	2	36		Coal/Oil	2	19.9
	3	41				
			Courtenay Bay	Oil	1	44.5
Tobique	1	10		Oil	2	12.3
	2	10		Oil	3	99.0
				Oil	4	99.0
Grand Falls	1	15.3				
	2	15.3	Dalhousie	Oil	1	102.0
	3	15.3		Coal/Oil	2	183.0 [2]
	4	15.3				
			Coleson Cove	Oil	1	335.0 [4]
Milltown	7	3.6		Oil	2	310.0 [3]
				Oil	3	335.0 [4]
Sisson	1	8.5				
			Lepreau Nuclear	Uranium	1	630.0 [5]
Musquash	2	5.2				
			Moncton	Oil	1	22.5
			Grand Manan	Oil		3.3
Total Hydro		845.5	Total Thermal			2284.2MW

1 Net megawatt values are derived by subtracting station service requirements from Gross Megawatt Capability.

2 Dalhousie Unit 2 capability is reduced by 20 MW to recognize the ownership by the Maritime Electric Company of Prince Edward Island.

3 Coleson Cove Unit 2 available to NB Power at 184 MW until November, 1985 and 310 MW thereafter because of participation sales.

4 Coleson Cove units 1 and 3 available at 198 MW each until November, 1985 and 335 MW thereafter because of participation sales.

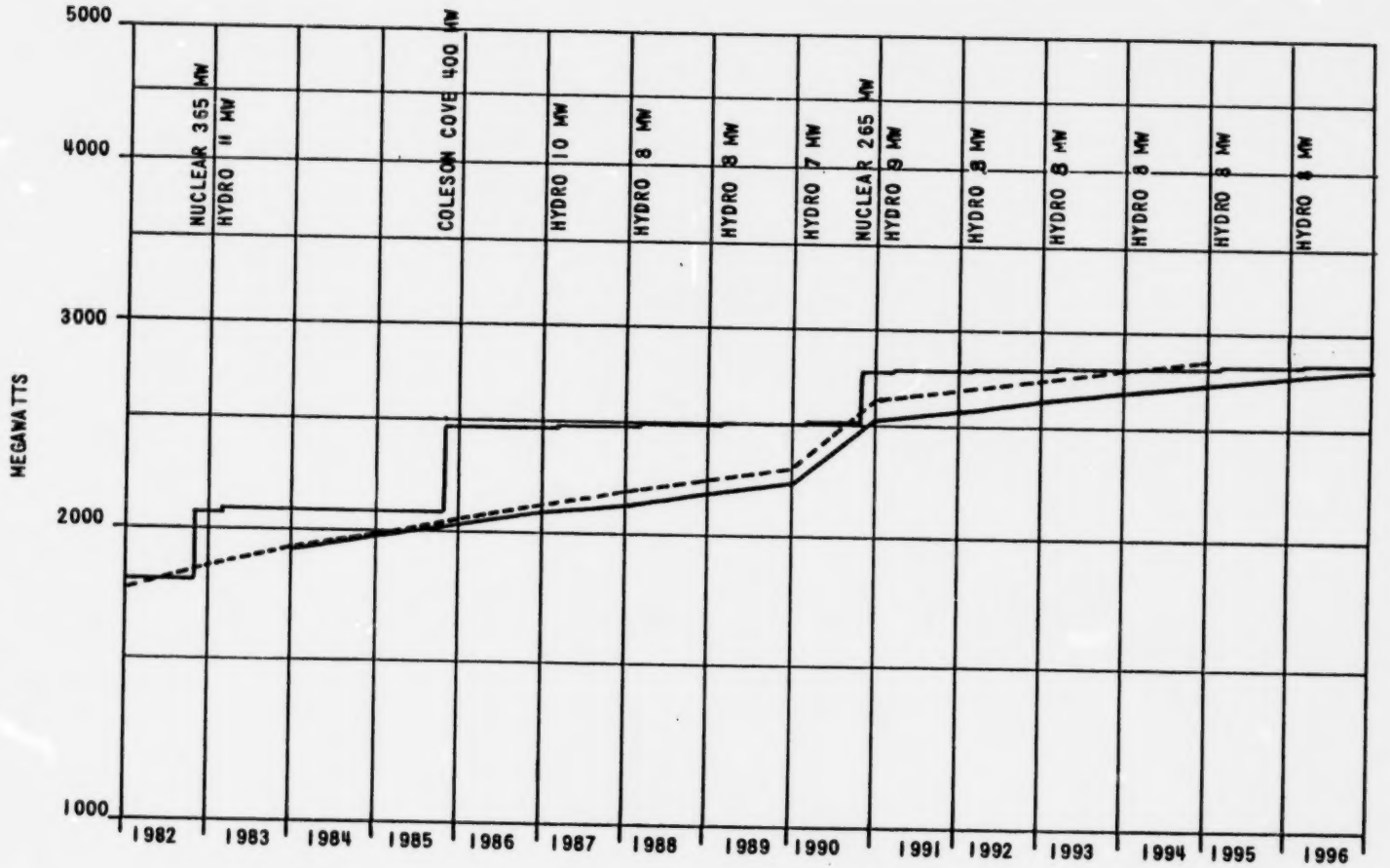
5 Lepreau Nuclear - Expected Commercial Operation in early 1983. Participation Sales of 265 MW from this unit.

FIGURE 11

LOAD PLUS RESERVE

VERSUS

SUSTAINED ELECTRICAL CAPABILITY



LEGEND:

——— SUSTAINED ELECTRICAL CAPABILITY

——— 1982 LOAD FORECAST PLUS RESERVE

- - - - - 1981 LOAD FORECAST PLUS RESERVE

VIII ALTERNATIVE PLANS OF ACTION

a) General

This section deals with alternatives available to meet the requirements of the NB Power system beyond those that can be met by existing and committed resources.

NB Power has over the past twenty years developed a succession of strong interconnections with its neighbouring utilities thus enabling it to achieve maximum flexibility in either purchasing its firm requirements from one of these interconnected systems if they should have a surplus or installing more economic generation internally than it could otherwise have done on an isolated basis. Thus in the development of any alternative supply, whether it be a purchase or an internal addition, close co-ordination is maintained with all adjoining utilities to ensure NB Power is in a position to take maximum advantage of any possibility.

To ensure the availability of the best energy sources to meet the requirements of the consumers at all times, it is necessary to consider all forms of supply. This includes the high capacity factor type of sources required to meet that part of the load which is reasonably constant (base load) as well as lower capacity factor sources that can best supply that part of the load which is present only at times of high demand (peak load). The mix of these two types must be analyzed to arrive at the most technically and economically desirable manner of meeting the varying daily, weekly, monthly and seasonal power system demands. Load management techniques tend to be most effective in systems in which thermal (fossil fuelled) generation supplies most of the demand. Such is not the case in New

Brunswick where we have a good mix of generation including hydro. Some of NB Power's required demand can also be supplied by purchases from neighbouring utilities through existing or future interconnections where economic and secure supplies are available.

A summary of alternatives being considered to fulfill the requirements of the NB Power system are presented here.

b) Nuclear

Nuclear power has become an economical and environmentally acceptable means of supplying the base load, high load factor, requirements of a power system. This is not to say, however, that all of the utility's future requirements should be met from nuclear because there are both technical and economic constraints which require a mix of various forms of generation to obtain an optimum solution. Most power utilities have found a maximum of 50% to 60% of their total requirement could technically and economically be derived from nuclear. New Brunswick's first nuclear unit is being commissioned at Point Lepreau on the Bay of Fundy for first commercial service in early 1983. The Point Lepreau site can ultimately be developed to include up to four such units.

Analysis of the deficiencies existing throughout the period indicate a second 630 MW nuclear unit, which is the smallest CANDU size economically available, would not be required in service solely to meet New Brunswick requirements well into the 1990's unless, of course, earlier development was undertaken with the participation of the Federal Government and unit participation for an extended period of years, by other utilities.

c) Coal-Fired Thermal Generation

The extent of New Brunswick's indicated and proven resources appear to be in the order of:

i) Grand Lake Area - up to 18 million tons presently indicated.

ii) Beersville - Approximately 12-16 million tons.

iii) Lake Stream - Although less exploration has been done on this area current estimates suggest somewhat less than the previously suggested 10 million tons.

It is believed that the total minable reserves could approach 50 million tons but further effort will be required before any really firm indications can be given. NB Power has embarked on a coal exploration program in an effort to confirm the actual coal reserves available within the province.

The known reserves indicate an ample supply of minable coal to fuel 200 MW to 300 MW of added coal-fired thermal generation.

In the light of the high sulphur content of New Brunswick coal, consideration of an expanded coal burning plant capability continues to be qualified by doubt as to the establishment of emission standards related to the "acid rain" situation. This is a crucial issue for New Brunswick where the existance, and expansion, of a viable provincial coal industry would be threatened by the development of regulations to meet "National" objectives without due regard to the real impact, environmentally or economically, on New Brunswick.

It is, of course, equally factual that the uncertainty in oil costs, and diminishing security of such supply, has placed a renewed emphasis on coal utilization. Practical considerations of our New Brunswick coal, both as to quantity and quality, would appear to preclude its use in other than a possible future extension to the Grand Lake plant and a possible conversion of Dalhousie #1 unit.

d) Conversion of Oil-Fired Thermal Generation

Conversion of existing oil-fired generating units to burn fuels such as coal or natural gas is being examined as a means of displacing oil fueled generation. Studies have been undertaken to fully examine the potential benefits to New Brunswick consumers of various conversion alternatives.

i) Coal Conversion

Conversion of units to burn coal involves major capital expenditures for the equipment necessary to handle and process the coal as well as the boiler and stack modifications and probable emission control requirements. It must also be recognized that units not originally designed with coal burning in mind will suffer a loss in total capability due to the smaller furnace volumes involved in oil burning plants.

Two phases of a proposed three phase feasibility study into the conversion of the Coleson Cove station to coal have been completed. This study is being performed in cooperation with the Federal Government under the off oil program. Results to date have demonstrated the overall technical feasibility of the conversion and identified

the potential for economic viability. A decision to proceed with the final detailed phase of study, is contingent upon establishment of environmental and financing criteria for the project.

The coal/oil-fired unit #2 at Dalhousie enhances the conversion possibility of #1 unit. The Dalhousie unit #1 boiler design included provisions for possible conversion to coal. This together with existing coal handling facilities installed to meet the requirements for unit #2 at Dalhousie improve the practicality of converting the #1 unit at Dalhousie. This will be the subject of further study. Consideration must also be given to environmental impacts of any such conversions and to the effect of possibly intensified emission controls.

ii) Coal-Oil Slurry Demonstration

The use of a mixture of coal in oil, referred to as a coal/oil slurry, was earlier investigated in a joint Federal Government/NB Power program at the Chatham Plant. The intent of the program was to investigate the technical and economic viability of fueling power plant boilers, originally designed for oil firing only, with a coal/oil mixture thus reducing the amount of oil required. In addition a related project was undertaken, and completed, to process the coal into a form with reduced content of sulphur and ash. Some technical problems persisted but the program demonstrated rather well the actual conditions that would exist in full scale use of such an "agglomerated" fuel. In terms of the economic feasibility of the concept, it was determined that coal/oil mixture fuel would be best applied in a station with expected low capacity factor operation. It was further concluded that

development of the concept even at this level would be dependent on the prior development of a coal/oil mixture supply industry. Also it does not, of course, fully eliminate the need for oil.

Joint design studies were carried out with the Canadian Electrical Association at the Dalhousie Plant where the requirements for coal/oil fueling of the 100 MW #1 unit were examined.

Any such conversion must be assessed in comparison with full conversion to coal. Both approaches are, of course, dependent on the environmental impacts which would develop along with technical and economic viability but the coal/oil approach does not have the attraction of full coal conversion where that is possible.

The work carried out on coal/oil slurry use, and coal preparation, has placed NB Power in the forefront of a developing technology and allowed first hand assessment of the process as a fueling strategy.

iii) Coal Water Mixture Demonstration

As a follow-up to the above program, NB Power is currently preparing to demonstrate the cumbustion of coal water mixture at the Chatham Generating Station. This program is being undertaken in cooperation with the Federal Department of Energy, Mines and Resources and The Cape Breton Development Corporation, (CBDC). Under terms of a tri-partite agreement, NB Power will burn up to 3000 tons of the experimental fuel in each of the two units at Chatham. The fuel will be manufactured by CBDC using a process developed by Swedish researchers. The results of this demonstration program will provide the necessary

technical and economic information for the assessment of commercial application of the technology.

iv) Natural Gas Conversion

Any decision by the Federal Government to have natural gas available to the Maritimes makes the possibility of using natural gas as a replacement fuel for imported oil an interesting possibility. While the burning of natural gas as a fuel for thermal plants is not favoured by either the producing provinces or the Federal Government as a long term commitment there is a clear acceptance of the role it can fulfill in the development of a viable market in the short term. The Coleson Cove plant has design provisions consistent with natural gas fueling. Such a conversion would also provide a security advantage in that the fuel is a Canadian resource.

This alternative will be further developed as the supply situation clarifies as to date of availability in the province, and probable cost and supply structures.

e) Peat Fired Thermal Generation

Due to the rapidly rising costs of oil, continuing research is being carried out in the quest for alternate fuels which can be used in the production of electricity.

Thermal peat, such as is known to exist in substantial quantities throughout the province, has been used in electrical generating stations for many years in several European countries. Over the past 5 years extensive inventory of the peat resources within the Province has been carried out by the

Provincial Department of Natural Resources. The field work was completed in 1981. This work was jointly funded by the Province and DREE.

NB Power is directly involved in developments relating to the New Brunswick peat resource and has worked closely with the appropriate Provincial and Federal Government Departments in an effort to determine the feasibility of utilizing this indigenous resource. The Federal Government has completed three reports relating to peat as a viable energy resource for Canada (see references 3, 4 and 5).

The most recent report entitled "Feasibility for the Peat Fired Station with Specific Reference to Northeast New Brunswick" was released in the spring of 1980. The study related to the possible construction of a small (40 MW) "pilot" peat burning project.

NB Power is continuing discussions with the various government groups involved and is attempting to develop a practical proposal for a project that would effectively serve as a demonstration facility in helping to determine the true merits of such a resource for producing electricity from peat in Canada. The economics do not appear to support a project solely as an electrical energy producer in competition with other alternative sources available and under development. It will, therefore, require recognition of its value as a demonstration project with appropriate financial support.

f) Hydraulic Generation

i) Tidal Power Generation

Development of tidal generation in the upper reaches of the Bay of Fundy has been the subject of considerable study.

A major study under the direction of the Atlantic Tidal Power Programming Board concluded in 1969 that development of tidal power was technically, but not economically, feasible under the then prevailing circumstances.

A major review of tidal power development in the Bay of Fundy was completed[6] in 1976 by the Governments of Canada, Nova Scotia, and New Brunswick. The study concentrated on 3 sites; a 3800 MW site at Cobequid Bay, Nova Scotia, between Economy Point and Cape Tenny, a 1085 MW site at the Mouth of Cumberland Basin, adjoining both New Brunswick and Nova Scotia and a 1550 MW site at the Mouth of Shepody Bay in New Brunswick. The Review Report identified the Cobiquid Bay (Minas Basin) and Cumberland Basin sites as being of equal economic viability with preference being given to the smaller Cumberland Basin site. Because of the tremendous financial burden of a tidal development, particularly during its early years of operation, such a project would require heavy involvement by the Federal Government.

The Fundy Tidal Power Review Board recommended additional studies on the preferred site at the Mouth of Cumberland Basin.

Nova Scotia and the Federal Government have recently completed an update of costs and economic viability of tidal power in the Bay of Fundy with specific reference to the Minas Basin site which is located wholly in the Province of Nova Scotia. This "Update 1982" concludes that Tidal Power economic viability has improved since the 1976 study.

ii) Other Hydraulic Generation

The overall long term potential for development of hydraulic generation within the province on the Saint John River system in New Brunswick has been analyzed in a study carried out for NB Power[7] in 1975.

Since that time a number of more detailed investigations have been undertaken in order to determine what projects might be undertaken to assist in meeting forecast requirements and to further reduce dependency on imported oil.

Studies have been completed showing the definite benefit of raising the Mactaquac Headpond by 3 feet. This project would increase the energy production from the Mactaquac generating station displacing some 100,000 barrels of oil per year. The project is being actively pursued with the expectation that the headpond can be raised in the near future.

Another project which has been given intense consideration in recent years is the potential Green River "pumped storage" project. The development would be located about two miles upstream of the present City of Edmundston owned Second Falls hydro development on the Green River. It would create a 17 mile long lake and would have an annual energy generating capability of some 130,000,000 KWh's from two 80,000 kw generating units.

The Green River development continues to be looked at as a project for the future but the exact date will

depend on relative economics as compared to other development opportunities and on the extent of load growth actually experienced.

A project of interest to NB Power because of the large amount of energy associated with it is Grand Falls redevelopment. Redevelopment with no change in the headpond operating level and an added plant with an installed capacity of 300 MW could be developed to produce an average annual energy output of 386,000,000 KWh. With a 20 foot increase in headpond level the same installed capacity could produce an average annual energy output of 655,000,000 KWh.

Other hydraulic development potentials of interest are:

- Development of the Morrill site (between Beechwood and Grand Falls) with an installed capacity of approximately 140 megawatts.

- The possibility of "pumped storage" operation at the existing Tobique Plant which would be related largely to better utilizing overall system generating capability.

- Development of new reservoirs and increasing the size of existing ones to increase energy production during low river flow periods.

- Development of hydro and/or pumped storage at other potential sites throughout the province.

These hydro development possibilities are being assessed both on their ability to supply the short duration, peak electrical demand requirements of the power system and on their ability to displace the oil fuel which would otherwise be required. This latter use would appear to offer the best benefits during the next ten years. It becomes, then, a matter of balancing their economic and development effects against the opportunity to secure an energy source to further displace oil dependency.

Of continuing interest to NB Power is the potential development of the Dickey-Lincoln School project in northern Maine. This project would provide New Brunswick with additional energy from its own hydro plants because of the increased river flows during the low flow months resulting from stored water and regulated discharges from the very large Dickey reservoir. Of the estimated additional 350 GWH which could be produced annually from NB Power's hydro plants downstream of Dickey-Lincoln School New Brunswick would undoubtedly be obligated to return a proportion to the United States under the terms of agreements which would have to be developed between Canada and the United States.

Interest in and support for, this project appears to have decreased in the United States during the last year. However, NB Power will continue to maintain liaison with United States authorities concerned with the project.

g) Purchases

Purchases from interconnected utilities particularly Hydro-Quebec can provide a major source of surplus energy to replace any expensive thermal energy and an opportunity to defer generation installations until larger, more economic projects can be undertaken. Such purchases depend on the availability of surplus generation from the selling utility. To take advantage of these opportunities on-going liaison is constantly maintained with neighbouring utilities.

There will continue to be an availability of surplus energy from Hydro-Quebec throughout the 1980's. This energy is normally not classified as firm and, therefore, cannot be considered to meet sustained electrical demand. However, it continues to provide a replacement for expensive imported oil now used to fuel NB Power thermal stations. While such "economy" purchases do provide a saving the purchase price is directly related to the cost of oil which places a limit on the benefits that can be achieved. NB Power maintains a close working relationship with Hydro-Quebec and is in a position to take full advantage of the opportunities available. Recent negotiations with Hydro-Quebec have resulted in the decision to proceed with the addition of a second interconnection which will essentially double the capability from Hydro-Quebec.

The new interconnection and schedule for completion of the various components are as follows:

1. In April 1983 a temporary 138,000 kV radial interconnection will be put in service which allows NB Power to import about 50 MW to serve part of the northwest area of the province.

2. In November 1984 the full radial service at 315,000 kV is expected to be in operation. This will allow NB Power to import the maximum amount of generation that can technically be utilized in the northwest of the province. This is presently expected to be about 150,000 KW with the ability to increase as the potential to do so arises.

3. In October 1985 the full interconnection will be in service with the completion of the 350,000 KW high voltage direct current terminal. The terminal will connect with the 345,000 kV transmission system in New Brunswick. With the completion of this terminal, NB Power will be able to import an additional 500,000 KW from Hydro-Quebec.

Surpluses available from New England[8] and Nova Scotia tend to be more expensive than Hydro-Quebec energy since they come from gas turbines and smaller thermal units. However, these interconnections do provide opportunities for short term purchases when required.

h) Load Management

"Load Management" is a term that encompasses so many things it is hard to use consistently. In the context of this document it refers to efforts to manage customer load as seen from the utility side of the electric meter. Supplying energy in the night during the "off-peak" period can affect operational economies because of increased efficiency and utilization of the thermal generators to meet this portion of the load.

Shifting a portion of the peak load to a convenient time where it can be more easily supplied may lower both the peak and sustained electrical demand. Depending upon the nature of the load being supplied, and the generating system supplying it, such load shifting practices can have an beneficial impact on generating costs and requirements for future generation.

NB Power has, for many years, offered "off-peak" interruptible energy to major industries in the province which have their own generation and have the capability of utilizing interruptible energy by reducing their own generation. This has had a beneficial affect on costs for both the utility and the industries.

NB Power has on occasion examined the feasibility of shifting load from the peak to the off-peak period for the benefit of both NB Power and any affected customers. This type of load management technique has beneficial affects primarily to systems which have predominantly thermal generation. NB Power, however, with its great amount of peaking hydro capability effectively levelizes the thermal generation requirement over a significant portion of the day. Shifting load from the peak period would result in some re-scheduling of the hydro to cover the altered peak. However, the resulting load supplied by the thermal generation and the sustained electrical capability needs remain relatively unchanged.

NB Power continues to review means of more accurately predicting the "nature" of loads and hence of better predicting future requirements both with and without load management.

i) Combustion Gas Turbine Generation

Gas turbines in general are characterized by low capital cost, high operating cost and short acquisition and installation times. These turbines are, therefore, primarily suitable for low capacity factor operation either as reliable sources for supplying short-term, or unpredicted, peak demands or for meeting an area peaking requirement where an economic deferral of transmission facilities can be achieved.

In the New Brunswick system, their possible application has been largely considered as an alternative to hydro peaking capability or for transmission deferrals. Since New Brunswick has a substantial hydro peaking capability, both developed and undeveloped, the latter use of transmission deferrals has appeared more relevant although no specific applications have been found economic in NB Power's planning.

j) Alternate Energy Sources

NB Power continues to maintain a full knowledge of latest technology in the use of alternate fuels for electrical generation. Activity in this area to date has largely been to ensure a current knowledge of alternative energy sources such as wood, solar collectors, passive heat collection, ground water sources, and wind generation.

Wood burning for power generation has been a subject of discussion with both government and industry. Key questions concern the availability of a long term waste wood supply and the cost levels that would be achieved. Use of wood wastes by the wood processing industries is becoming a more active consideration as oil prices continue to escalate with some of our major industry clearly moving in that direction.

Actual utilization of windmills and solar collectors has been undertaken by NB Power in order to gain direct knowledge of cost, efficiency, performance, and maintainability. As an example, NB Power constructed an office at Shediac utilizing solar collectors, water storage and heat pump concepts. NB Power was one of three Canadian utilities participating in the "Study of the Potential for Megawatt Scale Wind Power Plants in Electrical Utility Systems" for the Federal Department of Energy, Mines and Resources. This study outlined the annual costs and benefits of a large scale wind turbine generator (WTG) installation. The results continue to demonstrate that some applications are possible but many questions remain to be answered relating to such subjects as equipment viability, price, service life costs and the actual contribution such generation really makes in meeting any significant part of energy demand. Such questions will undoubtedly be considered in various continuing studies and actual pilot installations.

Energy conservation continues to be a major concern of NB Power both in terms of its own operations and in its efforts to assist consumers in practical conservation effects. A low interest loan program is operated in cooperation with the Provincial Government to promote the installation of improved

insulation in homes. As well, NB Power is participating in the administration of the Canada Home Insulation Program and is also involved in research related to the development of more energy efficient buildings. Earlier examples of this program are the Rothesay District Office, Bathurst District Office and an energy demonstration home in Nasonworth outside Fredericton with the concentration on developing information which can assist homeowners in making logical decisions.

NB Power also maintains through its field offices, with specialized back-up at its Head Office, an ability to advise consumers directly on the availability of the various support programs, to answer questions on specific concerns, and to provide direct homeowner advice on conservation concerns.

k) Waste Heat Utilization

i) Trout and Salmon Ponds

NB Power and the Department of Natural Resources have been conducting a cooperative aquaculture program at the coal-fired thermal plant at Grand Lake, since 1975. This first of a kind project in Canada utilizes the warm water discharge from the plant to accelerate the growth of salmon and trout throughout the fall, winter and spring months. The 200,000 salmon and trout raised in the ponds have been used to stock New Brunswick's lakes and streams. In addition to supplying stock for sport fishing, a portion of the salmon smolts raised were supplied to New Brunswick's commercial aquaculturists for further grow out and subsequent marketing. The success of this

program has attracted international attention and demonstrates the opportunity which warm water from a power plant presents to our fledgling aquaculture business.

ii) Warm Water Hatchery

A minimum of 30 months is required to raise a young salmon to smolt, or sea run size, in a traditional cold water hatchery. Experiments undertaken at the Grand Lake aquaculture project proved that this could be reduced to 18 months by hatching and rearing in power plant warm water. This, of course, results in significant cost savings. Based on this an experimental hatchery was constructed, in 1980, to determine if the comparable savings could be achieved on a production scale. Results have been very successful and the hatchery currently can produce over one-half million small salmon and trout each year.

iii) Early Rearing

Other experimentation at these facilities has proven that rearing time could be even further reduced by increasing the temperature of the warm water by 6°C. To test this, the Department of Natural Resources and NB Power initiated a joint venture which utilizes waste steam from the plant to increase water temperature for fish rearing. The object is to achieve a mature salmon smolt in 10 months, rather than 18 months currently possible at Grand Lake or 30 months in a traditional hatchery. This early rearing feature together with the expansion of two rearing ponds has increased the salmon smolt production by 70,000.

The combined production of the current facilities at the Grand Lake aquaculture project is now comparable to the largest in Canada:

Trout ponds	-	320,000
Hatchery	-	500,000 salmon & trout
Early Rearing Ponds	-	10,000 salmon smolts.

iv) Greenhouse R&D

Based on the overall success of the waste heat aquaculture facility at the Grand Lake Plant and the optimistic results of a feasibility study conducted by NB Power, waste heat utilization has expanded to include greenhouse heating.

Two - one quarter acre greenhouses have been built in a waste heat-greenhouse demonstration project at the Grand Lake Plant. The warm condenser water from the plant which is poured over the outside of one of these greenhouses should result in energy savings of 50-75%. This "surface heated" greenhouse is expected to harvest its first crop of tomatoes in the spring of 1983.

In general, while alternative forms of energy production are still not seen as playing a large role in fulfilling New Brunswick's future energy requirements, it continues vital that maximum utilization be made of the opportunities that do exist. In addition, technological advances and changing relative economics may well alter their viability at some future date and their role could well increase. The question of conservation is another issue entirely and here it is vital that NB Power and the consumers who rely on it for safe, reliable,

and economic energy and supplies, exert every possible effort to assure that energy, in whatever form, is used wisely and efficiently.

IX DETAILED RESULTS OF COMPARISON

Tables and Figures, providing information on the data used in the comparison of generating capability with forecast demand plus reserve, to determine the surpluses and deficits which exist throughout the period 1982/83 to 1996/97 are presented in this section. Results of this comparison, as stated earlier, show that NB Power will not require additional generating capability beyond that presently committed until the mid 1990's for purposes of meeting in-province demand. New generation may, however, be recommended for installation for purpose of displacement of oil fuelled generation, with the support export participation sales where appropriate and where such developments appear to be in the long term interest.

A list of the data presented on the following pages is given below for the convenience of the reader.

Table III - Generating Station Capabilities

This Table gives the generating station net capabilities for all installations presently operating or under construction. See page 28.

Table IV - Forecast Demand (NB Peak Load)

This Table gives the forecast demand or peak load requirement for each year as taken from the NB Power's Load Forecast for the period 1982-1997.

Tables V,VI - Analysis of Load and Resources Review

These Tables show the comparison between forecast load plus required reserves and generating capability under consideration of peak electrical capability criterion (Table V) and sustained electrical capability criterion (Table VI). The units for all entries in these Tables are MW's.

Figure 1 - NB Power Annual Peak Demand

This figure presents a comparison of the 1982 and 1981 load forecasts. Actual peak loads experienced in recent years are plotted for comparison. See page 23.

Figure 2 - Load Forecasts Including Reserve Versus Sustained Electrical Capability

This Figure shows graphically the data of Table VI, the analysis of generation requirements and committed supplies for sustained electrical capability. See page 29.

TABLE IV

NB POWER FORECAST DEMAND

PEAK LOAD MONTH

FISCAL YEAR	DEMAND (Megawatts)
1982/83	1579
1983/84	1715
1984/85	1765
1985/86	1821
1986/87	1875
1987/88	1929
1988/89	1982
1989/90	2033
1990/91	2085
1991/92	2137
1992/93	2189
1993/94	2243
1994/95	2296
1995/96	2351
1996/97	2405

TABLE V

LOAD AND RESOURCE REVIEW
PEAK ELECTRICAL CAPABILITY CRITERION
(MONTH OF JANUARY)

Fiscal Year Apr/Mar	Forecast Load MW (1)	Req'd. Reserve MW (2)	Total Required MW (3)	Thermal Cap. MW (4)	Hydro Cap. MW (5)	Nuclear Cap. MW (6)	Nuclear Sales MW (7)	Available Nuclear Cap. MW (8)	Total Resource MW (9)[1]	Surplus/ Deficit MW (10)[2]
1982/83	1579.	365.	1944.	1257.	845.	630.	265.	365.	2467.	523.
1983/84	1715.	365.	2080.	1257.	845.	630.	265.	365.	2467.	387.
1984/85	1765.	365.	2130.	1257.	845.	630.	265.	365.	2467.	337.
1985/86	1821.	365.	2186.	1657.	845.	630.	265.	365.	2867.	681.
1986/87	1875.	373.	2248.	1657.	845.	630.	265.	365.	2867.	619.
1987/88	1929.	383.	2312.	1657.	845.	630.	265.	365.	2867.	555.
1988/89	1982.	394.	2376.	1657.	845.	630.	265.	365.	2867.	491.
1989/90	2033.	404.	2437.	1657.	845.	630.	265.	365.	2867.	430.
1990/91	2085.	630.	2715.	1657.	845.	630.	0.	630.	3132.	417.
1991/92	2137.	630.	2767.	1657.	845.	630.	0.	630.	3132.	365.
1992/93	2189.	630.	2819.	1657.	845.	630.	0.	630.	3132.	313.
1993/94	2243.	630.	2873.	1657.	845.	630.	0.	630.	3132.	259.
1994/95	2296.	630.	2926.	1657.	845.	630.	0.	630.	3132.	206.
1995/96	2351.	630.	2981.	1657.	845.	630.	0.	630.	3132.	151.
1996/97	2405.	630.	3035.	1657.	845.	630.	0	630.	3132.	97.

Notes:
1) Col. 9 = Col. 4 and Col. 5 + Col. 8
2) Col. 10 = Col. 9 - Col. 3

TABLE VI

LOAD AND RESOURCE REVIEW
SUSTAINED ELECTRICAL CAPABILITY CRITERION
(MONTH OF JANUARY)

Fiscal Year Apr/Mar	Forecast Load MW (1)	Req'd. Reserve MW (2)	Total Required MW (3)	Thermal Cap. MW (4)	Hydro Cap. MW (5)	Nuclear Cap. MW (6)	Nuclear Sales MW (7)	Nuclear Available MW (8)	Total Resource MW (9)[1]	Surplus/ Deficit MW (10)[2]
1982/83	1579.	234.	1813.	1257.	449.	630.	265.	365.	2071.	257.
1983/84	1715.	232.	1947.	1257.	460.	630.	265.	365.	2082.	134.
1984/85	1765.	228.	1993.	1257.	451.	630.	265.	365.	2073.	80.
1985/86	1821.	221.	2042.	1657.	451.	630.	265.	365.	2473.	431.
1986/87	1875.	216.	2091.	1657.	451.	630.	265.	365.	2473.	382.
1987/88	1929.	211.	2140.	1657.	461.	630.	265.	365.	2483.	343.
1988/89	1982.	205.	2187.	1657.	469.	630.	265.	365.	2491.	304.
1989/90	2033.	200.	2233.	1657.	477.	630.	265.	365.	2499.	265.
1990/91	2085.	456.	2541.	1657.	484.	630.	0.	630.	2771.	230.
1991/92	2137.	449.	2586.	1657.	493.	630.	0.	630.	2780.	194.
1992/93	2189.	442.	2631.	1657.	501.	630.	0.	630.	2788.	157.
1993/94	2243.	435.	2678.	1657.	509.	630.	0.	630.	2796.	118.
1994/95	2296.	427.	2723.	1657.	517.	630.	0.	630.	2804.	80.
1995/96	2351.	419.	2770.	1657.	525.	630.	0.	630.	2812.	42.
1996/97	2405.	411.	2816.	1657.	533.	630.	0.	630.	2820.	4.

Notes: 1) Col. 9 = Col. 4 + Col. 5 + Col. 8
2) Col. 10 = Col. 9 - Col. 3

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